Practitioner's Docket No. 297-010346-US(PAR)

CHAPTER II

Preliminary Classification:

Proposed Class:

Subclass:

NOTE: "All applicants are requested to include a preliminary classification on newly filed patent applications. The preliminary classification, preferably class and subclass designations, should be identified in the upper right-hand corner of the letter of transmittal accompanying the application papers, for example 'Proposed Class 2, subclass 129.'" M.P.E.P., § 601, 7th ed.

TRANSMITTAL LETTER TO THE UNITED STATES ELECTED OFFICE (EO/US)

(ENTRY INTO U.S. NATIONAL PHASE UNDER CHAPTER II)

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/FI99/00974	25 November 1999	26 November 1998

TITLE OF INVENTION: Method And Arrangement For Transmitting And Receiving RF Signals Through Various Radio Interfaces Of Communication Systems

APPLICANT(S): Risto VAISANEN, Kim KALTIOKALLIO

Box PCT
Assistant Commissioner for Patents
Washington D.C. 20231

ATTENTION: EO/US

CERTIFICATION UNDER 37 C.F.R. § 1.10*
(Express Mail label number is mandatory.)
(Express Mail certification is optional.)

I hereby certify that this Transmittal Letter and the papers indicated as being transmitted therewith is being deposited with the United States Postal Service on this date 24 May 2001, in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number EL627426589US, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Shauna Murphy
(type or print name of person mailing paper)

Signature of person mailing paper

WARNING: *Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. § 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.*

***WARNING:** Each paper or fee filed by "Express Mail" **must** have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. § 1.10(b).*
*"Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will **not** be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.*

NOTE: To avoid abandonment of the application, the applicant shall furnish to the USPTO, not later than 20 months from the priority date: (1) a copy of the international application, unless it has been previously communicated by the International Bureau or unless it was originally filed in the USPTO; and (2) the basic national fee (see 37 C.F.R. § 1.492(a)). The 30-month time limit may not be extended. 37 C.F.R. § 1.495.

***WARNING:** Where the items are those which can be submitted to complete the entry of the international application into the national phase are subsequent to 30 months from the priority date the application is still considered to be in the international state and if mailing procedures are utilized to obtain a date the express mail procedure of 37 C.F.R. § 1.10 must be used (since international application papers are not covered by an ordinary certificate of mailing—See 37 C.F.R. § 1.8.*

NOTE: Documents and fees must be clearly identified as a submission to enter the national state under 35 U.S.C. § 371 otherwise the submission will be considered as being made under 35 U.S.C. § 111. 37 C.F.R. § 1.494(f).

I. Applicant herewith submits to the United States Elected Office (EO/US) the following items under 35 U.S.C. § 371:

a. ☒ This express request to immediately begin national examination procedures (35 U.S.C. § 371(f)).

b. ☒ The U.S. National Fee (35 U.S.C. § 371(c)(1)) and other fees (37 C.F.R. § 1.492) as indicated below:

2. Fees

CLAIMS FEE	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
☐*	TOTAL CLAIMS 20	20 −20=	0	× $18.00=	$ 0
	INDEPENDENT CLAIMS 4	4 −3=	1	× $80.00	80.00
	MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ $270.00	
BASIC FEE**	☐ U.S. PTO WAS INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where an International preliminary examination fee as set forth in § 1.482 has been paid on the international application to the U.S. PTO: ☐ and the international preliminary examination report states that the criteria of novelty, inventive step (non-obviousness) and industrial activity, as defined in PCT Article 33(1) to (4) have been satisfied for all the claims presented in the application entering the national stage (37 C.F.R. § 1.492(a)(4)) .....$100.00 ☐ and the above requirements are not met (37 C.F.R. § 1.492(a)(1)) .....$690.00 ☒ U.S. PTO WAS NOT INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where no international preliminary examination fee as set forth in § 1.482 has been paid to the U.S. PTO, and payment of an international search fee as set forth in § 1.445(a)(2) to the U.S. PTO: ☐ has been paid (37 C.F.R. § 1.492(a)(2)) ..... $710.00 ☒ has not been paid (37 C.F.R. § 1.492(a)(3)) .....$1,000. ☐ where a search report on the international application has been prepared by the European Patent Office or the Japanese Patent Office (37 C.F.R. § 1.492(a)(5)) $860.00				1,000.00
	Total of above Calculations				=$1,080.00
SMALL ENTITY	Reduction by 1/2 for filing by small entity, if applicable. Affidavit must be filed also. (note 37 C.F.R. § 1.9, 1.27, 1.28)				–
	Subtotal				
	Total National Fee				$ 1,080.00
	Fee for recording the enclosed assignment document $40.00 (37 C.F.R. § 1.21(h)). (See Item 13 below). See attached "ASSIGNMENT COVER SHEET".				40.00
TOTAL	Total Fees enclosed				$ 1,120.00

*See attached Preliminary Amendment Reducing the Number of Claims.

i. ☒ A check in the amount of $1,120.00 to cover the above fees is enclosed.

ii. ☐ Please charge Account No. _____ in the amount of $ _____. A duplicate copy of this sheet is enclosed.

***WARNING:** *"To avoid abandonment of the application the applicant shall furnish to the United States Patent and Trademark Office not later than the expiration of 30 months from the priority date: * * * (2) the basic national fee (see § 1.492(a)). The 30-month time limit may not be extended." 37 C.F.R. § 1.495(b).*

WARNING: *If the translation of the international application and/or the oath or declaration have not been submitted by the applicant within thirty (30) months from the priority date, such requirements may be met within a time period set by the Office. 37 C.F.R. § 1.495(b)(2). The payment of the surcharge set forth in § 1.492(e) is required as a condition for accepting the oath or declaration later than thirty (30) months after the priority date. The payment of the processing fee set forth in § 1.492(f) is required for acceptance of an English translation later than thirty (30) months after the priority date. Failure to comply with these requirements will result in abandonment of the application. The provisions of § 1.136 apply to the period which is set. Notice of Jan. 3, 1993, 1147 O.G. 29 to 40.*

3. ☒ A copy of the International application as filed (35 U.S.C. § 371(c)(2)):

NOTE: Section 1.495 (b) was amended to require that the basic national fee and a copy of the international application must be filed with the Office by 30 months from the priority date to avoid abandonment. "The International Bureau normally provides the copy of the international application to the Office in accordance with PCT Article 20. At the same time, the International Bureau notifies applicant of the communication to the Office. In accordance with PCT Rule 47.1, that notice shall be accepted by all designated offices as conclusive evidence that the communication has duly taken place. Thus, if the applicant desires to enter the national stage, the applicant normally need only check to be sure the notice from the International Bureau has been received and then pay the basic national fee by 30 months from the priority date." Notice of Jan. 7, 1993, 1147 O.G. 29 to 40, at 35-36. See item 14c below.

a. ☐ is transmitted herewith.

b. ☐ is not required, as the application was filed with the United States Receiving Office.

c. ☒ has been transmitted

i. ☒ by the International Bureau.
Date of mailing of the application (from form PCT/1B/308): 6/2/00

ii. ☐ by applicant on _____.
Date

4. ☒ A translation of the International application into the English language (35 U.S.C. § 371(c)(2)):

a. ☐ is transmitted herewith.

b. ☒ is not required as the application was filed in English.

c. ☐ was previously transmitted by applicant on _____.
Date

d. ☐ will follow.

5. ☒ Amendments to the claims of the International application under PCT Article 19 (35 U.S.C. § 371(c)(3)):

NOTE: The Notice of January 7, 1993 points out that 37 C.F.R. § 1.495(a) was amended to clarify the existing and continuing practice that PCT Article 19 amendments must be submitted by 30 months from the priority date and this deadline may not be extended. The Notice further advises that: "The failure to do so will not result in loss of the subject matter of the PCT Article 19 amendments. Applicant may submit that subject matter in a preliminary amendment filed under section 1.121. In many cases, filing an amendment under section 1.121 is preferable since grammatical or idiomatic errors may be corrected." 1147 O.G. 29-40, at 36.

a. ☐ are transmitted herewith.

b. ☐ have been transmitted

i. ☐ by the International Bureau.
Date of mailing of the amendment (from form PCT/1B/308): _____

ii. ☐ by applicant on (date) _____.
Date

c. ☒ have not been transmitted as

i. ☒ applicant chose not to make amendments under PCT Article 19.
Date of mailing of Search Report (from form PCT/ISA/210:): 4/13/00

ii. ☐ the time limit for the submission of amendments has not yet expired. The amendments or a statement that amendments have not been made will be transmitted before the expiration of the time limit under PCT Rule 46.1.

6. ☒ A translation of the amendments to the claims under PCT Article 19 (38 U.S.C. § 371(c)(3)):

a. ☐ is transmitted herewith.

b. ☐ is not required as the amendments were made in the English language.

c. ☒ has not been transmitted for reasons indicated at point 5(c) above.

7. ☒ A copy of the international examination report (PCT/IPEA/409)

☒ is transmitted herewith.

☐ is not required as the application was filed with the United States Receiving Office.

8. ☒ Annex(es) to the international preliminary examination report

a. ☒ is/are transmitted herewith.

b. ☐ is/are not required as the application was filed with the United States Receiving Office.

9. ☒ A translation of the annexes to the international preliminary examination report

a. ☐ is transmitted herewith.

b. ☒ is not required as the annexes are in the English language.

10. ☒ An oath or declaration of the inventor (35 U.S.C. § 371(c)(4)) complying with 35 U.S.C. § 115

    a. ☐ was previously submitted by applicant on _____. Date

    b. ☒ is submitted herewith, and such oath or declaration

        i. ☐ is attached to the application.

        ii. ☒ identifies the application and any amendments under PCT Article 19 that were transmitted as stated in points 3(b) or 3(c) and 5(b); and states that they were reviewed by the inventor as required by 37 C.F.R. § 1.70.

        iii. ☐ will follow.

II. Other document(s) or information included:

11. ☒ An International Search Report (PCT/ISA/210) or Declaration under PCT Article 17(2)(a):

    a. ☒ is transmitted herewith.

    b. ☒ has been transmitted by the International Bureau. Date of mailing (from form PCT/IB/308): 6/2/00.

    c. ☐ is not required, as the application was searched by the United States International Searching Authority.

    d. ☐ will be transmitted promptly upon request.

    e. ☐ has been submitted by applicant on _____. Date

12. ☒ An Information Disclosure Statement under 37 C.F.R. §§ 1.97 and 1.98:

    a. ☒ is transmitted herewith.

        Also transmitted herewith is/are:

        ☒ Form PTO-1449 (PTO/SB/08A and 08B).

        ☒ Copies of citations listed.

    b. ☐ will be transmitted within THREE MONTHS of the date of submission of requirements under 35 U.S.C. § 371(c).

    c. ☐ was previously submitted by applicant on _____. Date

13. ☒ An assignment document is transmitted herewith for recording.

    A separate ☒ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.

_____

_____

_____

14. ☒ Additional documents:

a. ☒ Copy of request (PCT/RO/101)

b. ☒ International Publication No. WO 00/31885

i. ☒ Specification, claims and drawing

ii. ☐ Front page only

c. ☒ Preliminary amendment (37 C.F.R. § 1.121)

d. ☒ Other

Finnish Search Report, PCT/IB/304; PCT/IB/308; PCT/IPEA/402; Written Opinion, Response to Written Opinion

15. ☒ The above checked items are being transmitted

a. ☒ before 30 months from any claimed priority date.

b. ☐ after 30 months.

16. ☐ Certain requirements under 35 U.S.C. § 371 were previously submitted by the applicant on _____, namely:

AUTHORIZATION TO CHARGE ADDITIONAL FEES

WARNING: *Accurately count claims, especially multiple dependant claims, to avoid unexpected high charges if extra claims are authorized.*

NOTE: "A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).

NOTE: "Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).

☒ The Commissioner is hereby authorized to charge the following additional fees that may be required by this paper and during the entire pendency of this application to Account No. **16-1350**.

☒ 37 C.F.R. § 1.492(a)(1), (2), (3), and (4) (filing fees)

WARNING: *Because failure to pay the national fee within 30 months without extension (37 C.F.R. § 1.495(b)(2)) results in abandonment of the application, it would be best to always check the above box.*

☒ 37 C.F.R. § 1.492(b), (c) and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.492(d)), it might be best not to authorize the PTO to charge additional claim fees, except possible when dealing with amendments after final action.

☒ 37 C.F.R. § 1.17 (application processing fees)

☐ 37 C.F.R. § 1.17(a)(1)–(5) (extension fees pursuant to § 1.136(a).

☐ 37 C.F.R. § 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. § 1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 C.F.R. § 1.311(b).

NOTE: 37 C.F.R. § 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying . . . issue fee." From the wording of 37 C.F.R. § 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

☒ 37 C.F.R. § 1.492(e) and (f) (surcharge fees for filing the declaration and/or filing an English translation of an International Application later than 30 months after the priority date).

PLEASE SEND ALL CORRESPONDENCE TO:

Reg. No.: 24,622

Tel. No.: (203) 259-1800

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SIGNATURE OF PRACTITIONER

Clarence A. Green

(type or print name of practitioner)

PERMAN & GREEN, LLP

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PLEASE SEND ALL CORRESPONDENCE TO:

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Express Mail No.: EL627426589US

In re Application of: VAISANEN et al.

International Application No. PCT/FI99/00974

International Filing Date: 11/25/99

FILING DATE: Herewith ART UNIT:

TITLE: METHOD AND ARRANGEMENT FOR TRANSMITTING AND RECEIVING RF SIGNALS THROUGH VARIOUS RADIO INTERFACES OF COMMUNICATION SYSTEMS

ATTORNEY DOCKET NO.: 297-010346-US(PAR)

Box PCT
The Commissioner of Patents and Trademarks
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Dear Sir:

Please amend the above-identified, enclosed patent application as follows:

IN THE CLAIMS

Please amend claims 5, 6, 8, 9, 10, 11, 14, 15, 17, 18, 19 and 20, which are attached to the Preliminary Examination Report as Amended Sheets as rewritten below:

5. The receiver of claim 3, **characterized** in that it comprises means for controlling the gain of said first amplifier.

6. The receiver of claim 3, **characterized** in that the means (10, 11) for generating a mixing signal at the receive frequency comprises an RX synthesizer (10, S1) and controllable frequency divider (11, N1) for dividing the frequency of the output signal generated by the RX synthesizer.

8. The receiver of claim 3, **characterized** in that it comprises means (6, FX3) for controlling the cut-off frequency of low-pass filtering in order to perform channel filtering according to the selected radio interface.

9. The receiver of claim 3, **characterized** in that it comprises means for implementing channel filtering realized in a digital manner.

10. The receiver of claim 3, **characterized** in that it comprises means (7, GX2) for controlling the gain of the second amplifier.

11. The receiver of claims 3, **characterized** in that the signal processing path comprises substantially the same components for connecting to the different radio interfaces.

14. The transmitter of claim 12, characterized in that it comprises means for implementing channel filtering realized in a digital manner.

15. The transmitter of claim 12, **characterized** in that the means (10, 11) for generating a TX mixing signal at the transmit frequency comprises a TX synthesizer (13, S2) and controllable frequency divider (12, N2) for dividing the frequency of the output signal generated by the TX synthesizer.

17. The transmitter of claim 12, **characterized** in that it comprises means (17, GX3) for controlling the gain of the transmitter amplifier.

18. The transmitter of claim 12, **characterized** in that it comprises means (18, BX) for controlling the operating frequency band of the transmitter amplifier.

19. The transmitter of claim 12, **characterized** in that it comprises a bandpass filter for filtering the amplified transmission signal at the
carrier frequency, and means for selecting the pass band of the transmitter bandpass filter (3, FX2) so that it corresponds to the transmission frequency.

20. The transmitter of claim 12, **characterized** in that the signal processing path comprises substantially the same components for connecting to the different radio interfaces.

REMARKS

In accordance with 37 C.F.R. §1.121 (as amended on 11/7/2000) the rewritten claim(s) above are shown on separate page(s) marked up to show all the changes relative to the previous version of that section.

Respectfully submitted,

24 May 01

Clarence A. Green, Reg. No.: 24,622
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425 Post Road
Fairfield, CT 06430
(203) 259-1800
Customer No.: 2512

Date

Application entitled: METHOD AND ARRANGEMENT FOR TRANSMITTING AND RECEIVING RF SIGNALS THROUGH VARIOUS RADIO INTERFACES OF COMMUNICATION SYSTEMS

MARKED UP CLAIM(S)

5. The receiver of claim 3 ~~or 4~~, **characterized** in that it comprises means for controlling the gain of said first amplifier.

6. The receiver of ~~any one of~~ claims 3 ~~to 5~~, **characterized** in that the means (10, 11) for generating a mixing signal at the receive frequency comprises an RX synthesizer (10, S1) and controllable frequency divider (11, N1) for dividing the frequency of the output signal generated by the RX synthesizer.

8. The receiver of ~~any one of~~ claims 3 ~~to 7~~, **characterized** in that it comprises means (6, FX3) for controlling the cut-off frequency of low-pass filtering in order to perform channel filtering according to the selected radio interface.

9. The receiver of ~~any one of~~ claims 3 ~~to 8~~, **characterized** in that it comprises means for implementing channel filtering realized in a digital manner.

10. The receiver of ~~any one of~~ claims 3 ~~to 9~~, **characterized** in that it comprises means (7, GX2) for controlling the gain of the second amplifier.

11. The receiver of ~~any one of~~ claims 3 ~~to 10~~, **characterized** in that the signal processing path comprises substantially the same components for connecting to the different radio interfaces.

14. The transmitter of claim 12 ~~or 13~~, characterized in that it comprises means for implementing channel filtering realized in a digital manner.

15. The transmitter of claim 12, ~~13 or 14,~~ **characterized** in that the means (10, 11) for generating a TX mixing signal at the transmit frequency comprises a TX synthesizer (13, S2) and controllable frequency divider (12, N2) for dividing the frequency of the output signal generated by the TX synthesizer.

17. The transmitter of ~~any one of~~ claims 12 ~~to 16~~, **characterized** in that it comprises means (17, GX3) for controlling the gain of the transmitter amplifier.

18. The transmitter of ~~any one of~~ claims 12 ~~to 17~~, **characterized** in that it comprises means (18, BX) for controlling the operating frequency band of the transmitter amplifier.

19. The transmitter of ~~any one of~~ claims 12 ~~to 18~~, **characterized** in that it comprises a bandpass filter for filtering the amplified transmission signal at the carrier frequency, and means for selecting the pass band of the transmitter bandpass filter (3, FX2) so that it corresponds to the transmission frequency.

20. The transmitter of ~~any one of~~ claims 12 ~~to 19~~, **characterized** in that the signal processing path comprises substantially the same components for connecting to the different radio interfaces.

Method and arrangement for transmitting and receiving RF signals through various radio interfaces of communication systems

The invention relates to a method and arrangement for transmitting and receiving RF signals associated with various radio interfaces of communication systems. The invention finds particular utility in transceivers of general-purpose mobile stations.

Mobile communication systems are developing and expanding rapidly which has lead to a situation in which there are in many areas systems complying with several different standards. This has brought about a need for mobile stations that can be used in more than one system. Good examples are the digital systems called GSM (Global System for Mobile communications) and DCS (Digital Cellular System), which operate on different frequency bands but have otherwise similar radio interfaces. In addition, the modulation, multiplexing and coding schemes used may be different. The systems mentioned above use the time division multiple access (TDMA) method; other methods include the frequency division multiple access (FDMA) and code division multiple access (CDMA).

One possible way of making a mobile station capable of operating in multiple systems is to have in the mobile station completely separate signal paths for each system. This, however, would lead to an unreasonable increase in the mobile station size and manufacturing costs. Therefore, the goal is to design a mobile station in which the differences relating to the radio interfaces of the various systems could be largely dealt with by means of programming, instead of having separate signal processing paths.

It is known e.g. from patent application document EP 653851 a transceiver arrangement using one local oscillator the frequency of which falls between the lower operating frequency band and the higher operating frequency band such that one and the same intermediate frequency (IF) can be used for both operating frequency bands. However, the disadvantage of such a solution is that the necessary IF stages make the implementation rather complex, and the manufacturing costs of the device will be high because of the great number of components. Furthermore, the IF stages require filters in order to eliminate spurious responses and spurious emissions. In addition, channel filtering at the intermediate frequency sets great demands on the IF filters.

In a direct-conversion, or zero-IF, receiver the radio-frequency (RF) signal is directly converted into baseband without any intermediate frequencies. Since no IF

stages are needed, the receiver requires only a few components, therefore being an advantageous solution for general-purpose mobile stations which have multiple signal branches for different systems. To aid in understanding the problems relating to the direct conversion technique and prior art it is next described in more detail a prior-art solution.

Fig. 1 shows a direct conversion based arrangement for realizing a dual frequency band transceiver, known from the Finnish Patent document FI 100286. Depending on the receive frequency band, a RF signal received by an antenna is coupled by means of switch 104 either to a first receive branch (DCS) or second receive branch (GSM). If the received signal is in the DCS frequency band, it is conducted to bandpass filter 106, low-noise amplifier (LNA) 108 and bandpass filter 110. After that the signal is brought to block 112 which produces signal components having a 90-degree phase difference. The in-phase component I and quadrature component Q are further conducted by means of switches 114 and 134 to mixers 116 and 136. The mixers get their mixing signals from a DCS synthesizer 140 the frequency of which corresponds to the received carrier frequency so that the mixing produces the in-phase and quadrature components of the complex baseband signal. The baseband signal is further processed in the receive (RX) signal processing unit, block 139.

If the signal received is a GSM signal, switch 104 directs the received signal to the GSM branch which comprises, connected in series, bandpass filter 126, low-noise amplifier 128, bandpass filter 130 and phase shifter 132 which generates two signals with a mutual phase difference of 90 degrees. The signals are further conducted by means of switches 114 and 134 to mixers 116 and 136 where the mixing frequency is now determined by a signal coming from the GSM synthesizer 150 via switch 161. The signals produced by the mixers are further conducted to the baseband RX signal processing unit 139.

The DCS synthesizer comprises in a known manner a phase-locked loop (PLL) which includes a voltage-controlled oscillator (VCO) 141 the output signal of which is amplified at amplifier 146 thus producing the synthesizer output signal. The frequency of the signal from oscillator 141 is divided by an integer Y in divider 142 and the resulting signal is conducted to phase comparator 143. Similarly, the frequency of the signal generated by reference oscillator 158 is divided by an integer X in divider 144 and conducted to phase comparator 143. The phase comparator produces a signal proportional to the phase difference of said two input signals, which signal is conducted to a low-pass filter (LPF) 145 producing a filtered signal that controls the voltage-controlled oscillator 141. The phase-locked

loop described above operates in a known manner in which the output frequency of the synthesizer becomes locked to the frequency coming to the phase comparator from the reference frequency branch. The output frequency is controlled by varying the divisor Y.

The GSM synthesizer 150 comprises a voltage-controlled oscillator 150, amplifier 156, dividers 152 and 154, phase comparator 153 and a low-pass filter 155. The GSM synthesizer operates like the DCS synthesizer described above, but the output frequency of the GSM synthesizer corresponds to GSM frequency bands.

In the transmitter part, a baseband complex transmit (TX) signal is processed in a TX signal processing unit wherefrom the in-phase and quadrature components of the signal are conducted to mixers 162 and 182 that produce a carrier-frequency signal by multiplying the input signal by the mixing signal. If the transmission is at the DCS frequency, switch 161 selects the DCS synthesizer's output signal as the mixing signal. The carrier-frequency signal is conducted through switch 164 to the DCS branch where a 90-degree phase shift is first produced between the in-phase component and quadrature component, and the resulting signals are then summed, block 166. The resulting DCS signal is conducted to bandpass filter 168, amplifier 170, and bandpass filter 172. The RF signal thus produced is further conducted to the antenna 102 via switch 180.

If the transmission is at the GSM frequency, the output signal of the GSM synthesizer is used as the mixing signal. The resulting carrier-frequency signal is conducted to the GSM branch in which it is processed in the same manner as in the DCS branch blocks 186, 188, 190 and 192. The RF signal thus produced is conducted to the antenna 102 via switch 180. One and the same antenna 102 can be used in both transmission and reception if the TX and RX circuits are coupled to the antenna through a duplex filter, for example. If the apparatus is designed to operate in two or more frequency bands, it needs separate filters for each frequency band.

The circuit arrangement described above has, however, some disadvantages. First, separate carrier-frequency signal branches in the receiver and in the transmitter add to the complexity, size and manufacturing costs of the transceiver. Second, each operating frequency band needs a separate synthesizer of its own.

An object of the invention is to provide a simple solution for realizing a programmable transceiver operating in a plurality of systems in such a manner that the aforementioned disadvantages related to the prior art can be avoided.

In the direct conversion based transceiver according to the invention signal processing can be performed using one and the same signal processing line regardless of the system. This is achieved using the signal processing steps set forth below.

The method according to the invention for processing signals received from different radio interfaces of communication systems is characterized in that it comprises steps in which

- a carrier-frequency signal is received from a radio interface,
- the carrier-frequency signal is bandpass-filtered,
- the filtered carrier-frequency signal is amplified,
- an RX mixing signal at the receive frequency is generated,
- a complex baseband signal is generated from the received carrier-frequency signal by mixing it with the RX mixing signal,
- the baseband signal generated is low-pass-filtered,
- the baseband signal generated is amplified,
- the baseband signal is converted digital, and
- the baseband signal converted digital is processed to produce an information signal encoded and modulated into the received signal.

The method according to the invention for processing signals transmitted to different radio interfaces of communication systems is characterized in that it comprises steps in which

- a digital baseband quadrature signal is generated on the basis of the information signal to be transmitted,
- the digital baseband signal is converted analog,
- a TX mixing signal at the transmit frequency is generated,
- a carrier-frequency transmission signal is generated from the baseband signal by mixing it with the TX mixing signal,
- the carrier-frequency signal generated is amplified, and
- the transmission signal is sent to the radio interface.

The direct-conversion receiver according to the invention operating at different interfaces of communication systems is characterized in that it comprises

- antenna means for receiving a radio-frequency signal,
- bandpass filter for filtering a carrier-frequency signal,
- first RX amplifier for amplifying the filtered carrier-frequency signal,
- means for generating an RX mixing signal at the receive frequency,
- mixing means for generating a complex baseband signal from the received signal using the RX mixing signal,

- low-pass filter for filtering the baseband signal,
- second amplifier for amplifying the baseband signal,
- analog-to-digital converter for converting the baseband signal digital, and
- means for processing the baseband signal converted digital to produce an information signal encoded and modulated into the received signal.

The direct-conversion transmitter according to the invention operating at different radio interfaces of communication systems is characterized in that it comprises
- means for generating a digital baseband quadrature signal on the basis of the information signal to be transmitted,
- digital-to-analog converter for converting the baseband transmission signal analog,
- synthesizer for generating a TX mixing signal at the transmit frequency,
- mixing means for producing a signal at the carrier frequency from the baseband transmission signal using the TX mixing signal,
- TX amplifier for amplifying the signal at the carrier frequency, and
- antenna means for transmitting the amplified transmission signal at the carrier frequency.

Other preferred embodiments of the invention are described in the dependent claims.

In the present invention, signal band limiting is advantageously performed at the baseband frequency so that there is no need for "steep" filters and, therefore, system-specific filter lines. Filtering can thus be performed as low-pass filtering using a filter with a controllable cut-off frequency. This way, it is possible to completely avoid separate system-specific channel filtering circuits.

To enable the generation of mixing frequencies of the different operating frequency bands by one and the same synthesizer it is advantageously used frequency division of the synthesizer output signal. If the synthesizer's operating frequency is set higher than the frequencies used in the systems, it is possible to generate, in conjunction with the synthesizer frequency division, two mixing signals with a 90-degree phase difference, thus avoiding the need for phase shifters on the signal line and achieving a good phase accuracy.

Using the solution according to the invention it is possible to realize a general-purpose transceiver which is considerably simpler and more economical to manufacture than prior-art solutions. The circuit arrangement according to the invention requires only one TX signal branch and one RX signal branch. Moreover, one and

the same synthesizer may be used to generate the mixing signals. Furthermore, there is no need for channel filters operating at the radio frequency. Therefore, the circuitry can be easily integrated. Since the invention involves only a few components, the advantages of the transceiver according to the invention include small size and low power consumption.

The invention will now be described in more detail with reference to the accompanying drawing wherein

Fig. 1 shows a block diagram of a dual-band direct-conversion transceiver according to the prior art,

Fig. 2 shows in the form of block diagram a solution according to the invention for a direct-conversion transceiver operating in multiple systems.

Fig. 1 was already discussed in conjunction with the description of the prior art. Next, a transceiver according to the invention will be described, referring to Fig. 2.

Fig. 2 shows in the form of block diagram a transceiver according to the invention. A RF signal received through an antenna is conducted via matching circuits 1 to controllable bandpass filters 2. The matching circuits 1 may advantageously be controllable (AX) with respect to the operating frequency band. A controllable bandpass filter 2 may be advantageously realized using a plurality of bandpass filters so that the RF signal is conducted via switch elements controlled by a control signal FX1 from the matching circuit 1 to the bandpass filter that corresponds to the selected operating frequency band. The bandpass filter may also be realized so as to be adjustable and tuneable by means of programming. The bandpass filtered carrier-frequency signal is further conducted to a low-noise amplifier 4, the gain of which is advantageously controllable. The control signal is marked GX1 in the drawing. In addition to amplifier 4, it is also possible to have integrated amplifiers in connection with the bandpass filters.

The signal is then conducted to a mixer 5 in which the carrier-frequency signal is mixed with an RX mixing signal at the receive frequency to produce a baseband quadrature signal. The RX mixing signal is advantageously generated by a synthesizer 10 the output signal frequency of which is divided by a divider 11 so as to correspond to the selected receive frequency. The synthesizer 10 operates in a similar manner as the synthesizers depicted in Fig. 1. Thus it comprises a voltage-controlled oscillator VCO which produces an output signal. The frequency of the VCO output signal is divided by S1 in a divider in the phase-locked loop PLL. The

resulting signal is conducted to a first input of a phase comparator in the phase-locked loop. Similarly, the frequency of a signal generated by a reference oscillator in the phase-locked loop PLL is divided by an integer and conducted to a second input of the phase comparator. The phase comparator produces a signal which is proportional to the phase difference of the two input signals and conducted to a low-pass filter, and the filtered signal then controls the voltage-controlled oscillator VCO. The output frequency is controlled by varying the divisor S1.

The synthesizer output signal is divided in divider 11 by N1 so that the RX mixing signal corresponds to the selected receive frequency band. The output frequency of the synthesizer may be e.g. in the 4-GHz band, so that with 2-GHz systems the synthesizer output frequency is divided by two, and with 1-GHz systems it is divided by four (N1). This way, systems operating in the 1-GHz and 2-GHz bands can be covered with a synthesizer the operating frequency band of which is narrow with respect to the operating frequency.

To produce a quadrature baseband signal the mixer needs two mixing signals with a phase shift of 90 degrees. Phase-shifted components may be produced by a phase shifter in connection with the mixer or they may be produced as quotients generated already in the frequency divider 11, thus achieving an accurate phase difference. Therefore, it is advantageous to use a synthesizer operating frequency which is a multiple of the highest system frequency.

The in-phase component I and quadrature component Q from the mixer 5 are further conducted to low-pass filters 6. The higher cut-off frequency of the low-pass filters is advantageously controllable with control signal FX3. Thus the filtering can be performed at a bandwidth corresponding to the selected radio interface, and since the filtering is performed at baseband, it is easy to get the filtering function steep. Also, no strict demands are set on the bandpass filtering (2) of the RF signal.

The baseband signal is further conducted to a gain control block 7 which possibly includes an offset voltage correction block. On the other hand, considering the broad bandwidth of the CDMA system, the offset voltage can easily be removed by high-pass filtering. The amplifier advantageously realizes automatic gain control (AGC). Finally, the signal is converted digital in an analog-to-digital converter 8, and the digital baseband signal is further processed in a digital signal processor (DSP) 9. Channel filtering may also be performed digitally in the DSP, whereby the low-pass filtering of the baseband signal may be performed using a fixed cut-off

frequency. Then, however, the dynamics of the analog-to-digital converter must be considerably better.

In the transmitter part, a quadrature baseband signal is first digitally generated in block 9 on the basis of the information signal to be sent. The components of the digital signal are converted analog by digital-to-analog converters 14, whereafter the analog signals are low-pass filtered by low-pass filters 15. Advantageously, the cut-off frequency of the low-pass filters can be controlled with control signal FX4 so as to correspond to the specifications of the selected radio interface.

A TX mixing signal at the carrier frequency is generated by a synthesizer 13 and divider 12. The synthesizer 13 operates in a similar manner as the synthesizer 10 in the receiver part. Moreover, the synthesizers may share a reference oscillator. The frequency of the synthesizer output signal is controlled with control signal S2 within the synthesizer's operating frequency range. The frequency of the output signal from synthesizer 13 is divided in divider 12 so as to correspond to the selected transmission frequency band. Components phase-shifted by 90 degrees are generated from the TX mixing signal in order to perform complex mixing in mixer 16. The phase-shifted components may be generated in the same way as in the receiver part.

The signal at the carrier frequency is then amplified in an amplifier 17, the gain of which is advantageously controllable in order to set the transmission power and realize automatic gain control (AGC). The control signal is marked GX3 in Fig. 2. The signal is then conducted to a power amplifier 18. The operating frequency band of the power amplifier is advantageously selectable with control signal BX. This can be achieved e.g. such that the amplifier comprises partly separate signal lines for the different operating frequency bands.

The RF signal generated is filtered by a bandpass filter 3. The pass band of the bandpass filter is advantageously controllable with control signal FX2. This can be realized in the same way as in the receiver part. The receiver and transmitter part filters 2 and 3 are advantageously realized in duplex filter pairs for each transmit-receive frequency band associated with a given system. The filters may advantageously be surface acoustic wave (SAW) or bulk acoustic wave (BAW) filters so that several filters with their switches may be attached to one component.

The control signals in the mobile station transceiver according to Fig. 2 are preferably generated in a control block of the mobile station which advantageously comprises a processing unit such as a microprocessor. The control block generates

the signal on the basis of a system switch instruction input from the keypad of the mobile station, for example. System selection may be e.g. menu-based so that the desired system is selected by choosing it from a displayed menu by pressing a certain key on the keypad. The control block then generates the control signals that correspond to the selected system. The system switch instruction may also come via the mobile communication system in such a manner that data received from the system may include a system switch instruction on the basis of which the control block performs the system switch. Advantageously, a control program is stored in a memory unit used by the control block, which control program monitors the received data and, as it detects a system switch instruction in the data, gives the control block an instruction to set the control signals into states according to the selection instruction.

The implementation of the blocks described above is not illustrated in more detail as the blocks can be realized on the basis of the information disclosed above, applying the usual know-how of a person skilled in the art.

Above it was described embodiments of the solution according to the invention. Naturally, the principle according to the invention may be modified within the scope of the invention as defined by the claims appended hereto, e.g. as regards implementation details and fields of application. It is especially noteworthy that the solution according to the invention may be well applied to communication systems other than the mobile communication systems mentioned above. Apart from the cellular radio interface proper, the solution may be used to realize e.g. a GPS receiver for the location of a mobile station or other apparatus. Furthermore, the operating frequencies mentioned are given by way of example only, and the implementation of the invention is in no way restricted to them.

It is also noteworthy that the solution according to the invention may be applied to all current coding techniques such as the narrow-band FDMA (Frequency Division Multiple Access) and TDMA (Time Division Multiple Access), as well as the broadband CDMA (Code Division Multiple Access) technique. In addition, the solution according to the invention may be used to realize an FM (Frequency Modulation) receiver.

Below is a table listing some of the so-called second generation mobile communication systems to which the present invention may be applied. The table shows the most important radio interface related characteristics of the systems.

CELLULAR SYSTEM	AMPS	IS-54/-136	IS-95 US CDMA	GSM Global System for Mobile Communications	DCS 1800	PDC Personal Digital Cellular	DECT Digital European Cordless Telephone	PHS Personal Handy Phone System
RX FREQ. (MHz)	869-894	869-894	869-894	935-960	1805-1880	810-826, 1429-1453	1880-1900	1895-1918
TX FREQ. (MHz)	824-849	824-849	824-849	890-915	1710-1785	940-956, 1477-1501	1880-1900	1895-1918
RF BANDWIDTH	25 MHz	25 MHz	25 MHz	25 MHz	75 MHz	16 MHz 24 MHz	20 MHz	23 MHz
MULTIPLE ACCESS METHOD	FDMA	TDMA/ FDMA	CDMA/FDMA	TDMA/FDMA	TDMA/ FDMA	TDMA/FDMA	TDMA/ FDMA	TDMA/ FDMA
DUPLEX METHOD	FDD	FDD	FDD	FDD	FDD	FDD	TDD	TDD
NUMBER OF CHANNELS	832	832, 3 users/ channel	20, 798 users/ channel	124, 8 users/channel	374, 8 users/ channel	1600, 3 users/ channel	10, 12 users/ channel	300 4 users/ channel
CHANNEL SPACING	30 kHz	30 kHz	1250 kHz	200 kHz	200 kHz	25 kHz	1.728 MHz	300 kHz
MODULATION	FM	$\pi/4$ DQPSK	QPSK/ OQPSK	GMSK 0.3 Gaussian filter	GMSK 0.3 Gaussian filter	$\pi/4$ DQPSK	GFSK 0.3 Gaussian filter	$\pi/4$ DQPSK
CHANNEL BIT RATE	-	48.6 kb/s	1.2288 Mb/s	270.833 kb/s	270.833 kb/s	42 kb/s	1.152 Mb/s	384 kb/s

Below is another table listing some of the so-called third generation mobile communication systems to which the present invention may be applied. The table shows the most important radio interface related characteristics of the systems.

CELLULAR SYSTEM	WCDMA	
RX FREQ. (MHz)	2110 - 2170	1900 – 1920
TX FREQ. (MHz)	1920 – 1980	1900 – 1920
MULTIPLE ACCESS METHOD	CDMA	TDMA
DUPLEX METHOD	FDD	TDD
CHANNEL SPACING	5 MHz	5 MHz
MODULATION	QPSK	
CHANNEL BIT RATE	144 kb/s in rural outdoor, 500 kb/ s in urban outdoor and up to 2 Mb/s in indoor	

PCT/FI 99/00974
05 -02- 2001

Claims

1. A method for processing signals received from different radio interfaces of communication systems, **characterized** in that it comprises steps in which
- a carrier-frequency signal is received from a radio interface,
- the signal at the carrier frequency is bandpass-filtered,
- the filtered signal at the carrier frequency is amplified,
- an RX mixing signal at the receive frequency is generated,
- a complex baseband signal is generated from the received carrier-frequency signal by mixing it with the RX mixing signal,
- the baseband signal generated is low-pass filtered,
- the baseband signal generated is amplified or attenuated prior to analog-to-digital conversion,
- the baseband signal is converted digital, and
- the baseband signal converted digital is processed so as to produce an information signal encoded and modulated into the received signal,

wherein the signal prosessing parts for processing receive frequency signal are common for signals received from at least two different radio interfaces.

2. A method for processing signals transmitted to different radio interfaces of communication systems, **characterized** in that it comprises steps in which
- a digital baseband quadrature signal is generated on the basis of the information signal to be transmitted,
- the digital baseband signal is converted analog,
- a TX mixing signal at the transmit frequency is generated,
- a carrier-frequency transmission signal is generated from the baseband signal by mixing it with the TX mixing signal,
- the carrier-frequency signal generated is amplified, and
- the transmission signal is transmitted to the radio interface,

wherein the signal prosessing parts for processing transmit frequency signal are common for signals received from at least two different radio interfaces.

3. A direct-conversion receiver operating at different radio interfaces of communication systems, **characterized** in that it comprises

- antenna means for receiving a carrier-frequency signal from a radio interface,
- bandpass filter (2) for filtering the carrier-frequency signal,
- first receiver amplifier (4) for amplifying the filtered carrier-frequency signal,
- means (10, 11) for generating an RX mixing signal at the receive frequency,

- mixing means (5) for generating a complex baseband signal from the received signal by means of the RX mixing signal,
- low-pass filter (6) for filtering the baseband signal,
- second amplifier (7) for amplifying the baseband signal,
- analog-to-digital converter (8) for converting the baseband signal digital, and
- means (9) for processing the baseband signal converted digital so as to produce an information signal encoded and modulated into the received signal,

wherein the signal prosessing parts for processing receive frequency signal are common for signals received from at least two different radio interfaces.

4. The receiver of claim 3, **characterized** in that it comprises means for selecting the pass band of the bandpass filter (2, FX1) such that it corresponds to the receive frequency.

5. The receiver of claim 3 or 4, **characterized** in that it comprises means for controlling the gain of said first amplifier.

6. The receiver of any one of claims 3 to 5, **characterized** in that the means (10, 11) for generating a mixing signal at the receive frequency comprises an RX synthesizer (10, S1) and controllable frequency divider (11, N1) for dividing the frequency of the output signal generated by the RX synthesizer.

7. The receiver of claim 6, **characterized** in that said frequency divider is arranged so as to divide the output signal of the RX synthesizer always by at least two in order to generate an RX mixing signal.

8. The receiver of any one of claims 3 to 7, **characterized** in that it comprises means (6, FX3) for controlling the cut-off frequency of low-pass filtering in order to perform channel filtering according to the selected radio interface.

9. The receiver of any one of claims 3 to 8, **characterized** in that it comprises means for implementing channel filtering realized in a digital manner.

10. The receiver of any one of claims 3 to 9, **characterized** in that it comprises means (7, GX2) for controlling the gain of the second amplifier.

11. The receiver of any one of claims 3 to 10, **characterized** in that the signal processing path comprises substantially the same components for connecting to the different radio interfaces.

12. A direct-conversion transmitter operating at different radio interfaces of communication systems, **characterized** in that it comprises
- means (9) for generating a digital baseband quadrature signal on the basis of the information signal to be transmitted,
- digital-to-analog converter (14) for converting the baseband transmission signal analog,
- synthesizer (10, 11) for generating a TX mixing signal at the transmit frequency,
- mixing means (16) for producing a signal at the carrier frequency from the baseband transmission signal by means of the TX mixing signal,
- transmitter amplifier (7, 8) for amplifying the signal at the carrier frequency, and
- antenna means for transmitting the amplified transmission signal at the carrier frequency,

wherein the signal prosessing parts for processing transmit frequency signal are common for signals received from at least two different radio interfaces.

13. The transmitter of claim 12, **characterized** in that it comprises a controllable low-pass filter (15, FX4) for filtering a baseband transmission signal in order to perform channel filtering according to the radio interface selected.

14. The transmitter of claim 12 or 13, **characterized** in that it comprises means for implementing channel filtering realized in a digital manner.

15. The transmitter of claim 12, 13 or 14, **characterized** in that the means (10, 11) for generating a TX mixing signal at the transmit frequency comprises a TX synthesizer (13, S2) and controllable frequency divider (12, N2) for dividing the frequency of the output signal generated by the TX synthesizer.

16. The transmitter of claim 15, **characterized** in that said frequency divider is arranged so as to divide the TX synthesizer's output signal always at least by two in order to generate a TX mixing signal.

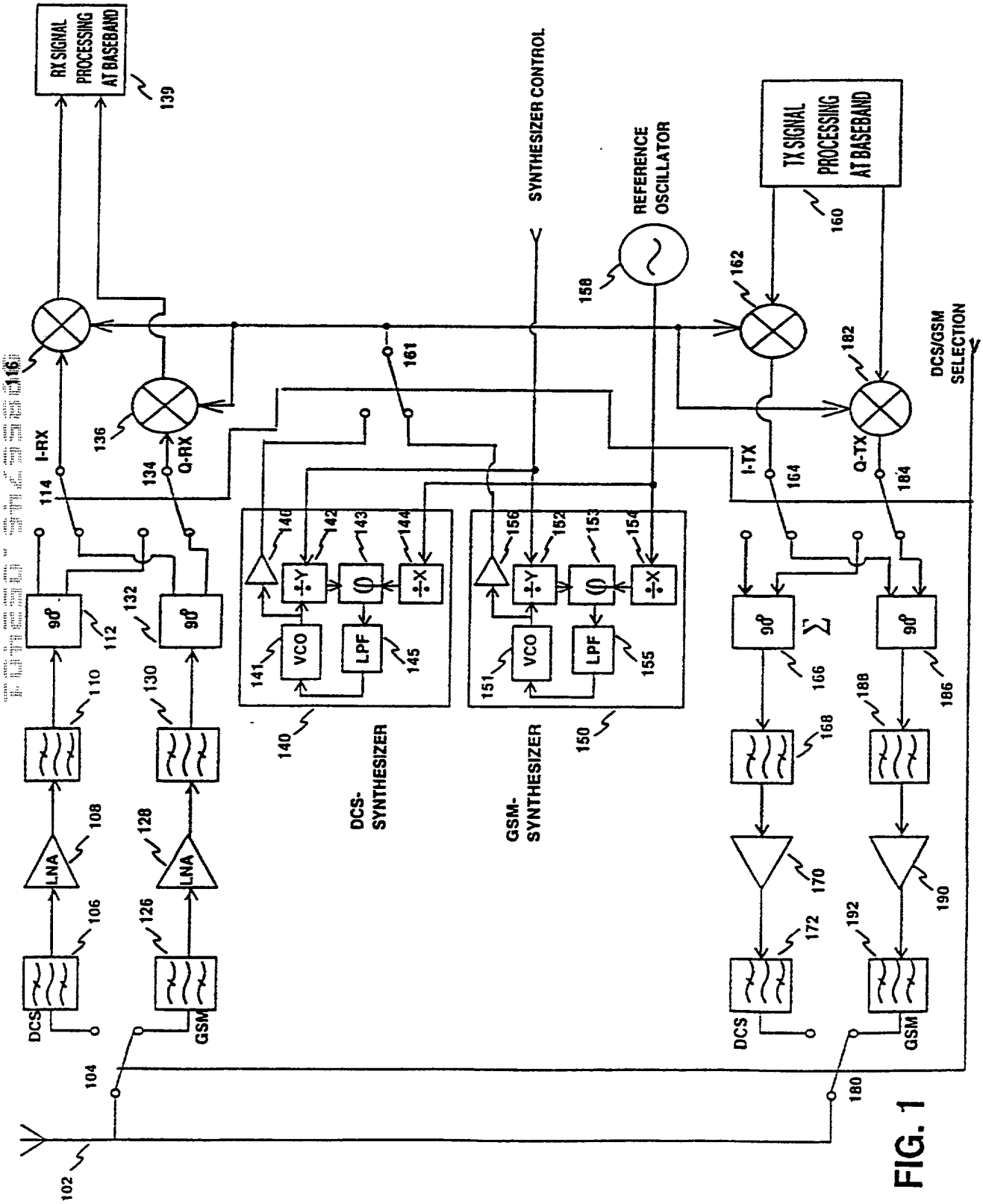
17. The transmitter of any one of claims 12 to 16, **characterized** in that it comprises means (17, GX3) for controlling the gain of the transmitter amplifier.

18. The transmitter of any one of claims 12 to 17, **characterized** in that it comprises means (18, BX) for controlling the operating frequency band of the transmitter amplifier.

19. The transmitter of any one of claims 12 to 18, **characterized** in that it comprises a bandpass filter for filtering the amplified transmission signal at the

carrier frequency, and means for selecting the pass band of the transmitter bandpass filter (3, FX2) so that it corresponds to the transmission frequency.

20. The transmitter of any one of claims 12 to 19, **characterized** in that the signal processing path comprises substantially the same components for connecting to the different radio interfaces.


RX SIGNAL PROCESSING AT BASEBAND
139
SYNTHESIZER CONTROL
REFERENCE OSCILLATOR
158
TX SIGNAL PROCESSING AT BASEBAND
160
162
161
116
I-RX
114
Q-RX
134
136
I-TX
164
Q-TX
184
182
DCS/GSM SELECTION
90°
112
132
110
130
LNA
108
128
106
126
DCS
GSM
104
102
180
140
141
142
143
144
VCO
LPF
145
DCS-SYNTHESIZER
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154
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GSM-SYNTHESIZER
166
168
170
172
186
188
190
192

FIG. 1

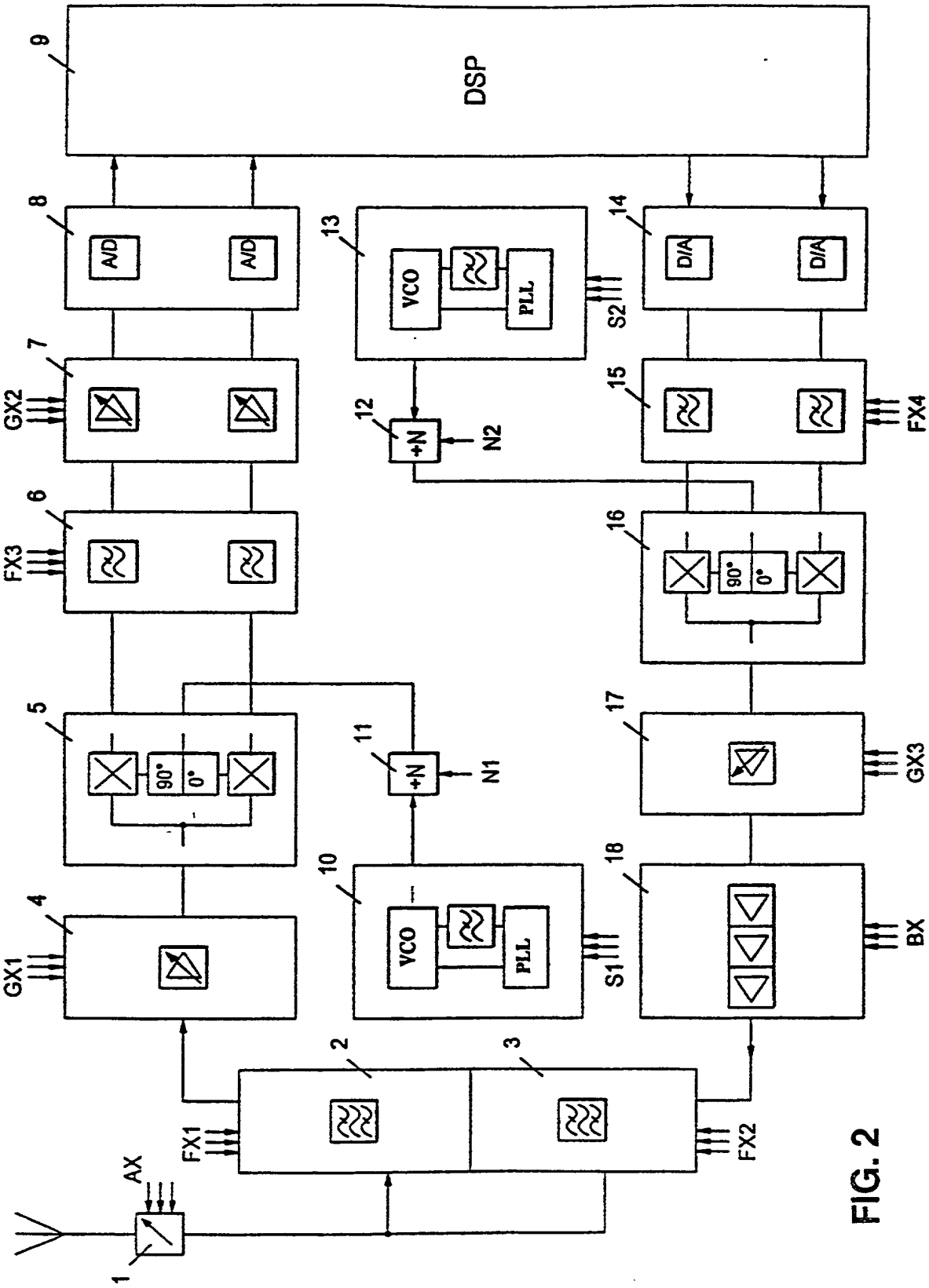
DSP
9
A/D
A/D
8
VCO
PLL
13
S2
D/A
D/A
14
7
GX2
12
+N
N2
15
FX4
6
FX3
16
90°
0°
5
11
+N
N1
17
GX3
4
GX1
10
VCO
PLL
S1
18
BX
2
3
FX1
FX2
AX
1

FIG. 2

Docket No.: 297-010346-US (PAR)

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Title: Method and arrangement for transmitting and receiving RF signals through various radio interfaces of communication systems

the specification of which

(check one)

☐ is attached hereto.

X was filed on 25 November 1999 as PCT International Application Number PCT/FI99/00974 and was amended on (if applicable) 5 February 2001

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International Application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

(Number)	(Country)	(Day/Month/Year Filed)	Priority Not Claimed
982559	Finland	26 November 1998	☐
PCT/FI99/00974	PCT	25 November 1999	☐
			☐
			☐

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

_____ (Application Serial No.) (Filing Date)

_____ (Application Serial No.) (Filing Date)

_____ (Application Serial No.: (Filing Date)

I hereby claim the benefit under 35 U.S.C. Section 120 of any United States application(s), or Section 365(c) of any PCT International Application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International Application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C.F.R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

_____ _____ (Application Serial No.) (Filing Date) (Status) (patented, pending, abandoned)

_____ (Application Serial No.) (Filing Date) (Status) (patented, pending, abandoned)

_____ _____ (Application Serial No.) (Filing Date) (Status) (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

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